THE EFFECT OF HOUSEHOLD MEMBERS' LANGUAGE USE AND ENGLISH ABILITY ON SNAP PARTICIPATION DECISION

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Abstract

The participation rate of non-citizen households eligible for the Supplemental Nutrition Assistance Program (SNAP) is much lower than the average participation rate of all eligible households. Using the Survey of Income and Program Participation (SIPP), this thesis explores the effect of household members' language use and English proficiency on their SNAP participation decision by estimating panel data econometric models. The main finding is that households whose members speak English at home are 5.1% more likely to participate in SNAP. The result implies that non-native households may have difficulties in applying for SNAP because of higher transaction costs of application. Therefore, policies targeted to reduce transaction costs facing non-native households would likely help increase their SNAP participation, which may lead to less food insecurity. However, the results also show that the effect of household members' English proficiency on their SNAP participation is not statistically significant. Since this result could be due to the limitations of the data, it would be worthwhile to conduct future research using more reliable measurement of English proficiency such as a well-designed test score.

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1. Introduction

Participation rates of the Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program (FSP) have substantially risen over the decades. Table 1 shows that the participation rates among eligible individuals was 31.7% in 1976 and was 74.8% in 1994 reaching its peak. Since then, the rates had fallen to 53.9% in 2001 and then gradually risen to 72.2% in 2009.

However, the 2009 SNAP participation rate among citizen children living with noncitizen adults was 62.8%, which is 10% lower than that among all eligible individuals. Furthermore, the SNAP participation rate of eligible households with noncitizens was 55.1% in 2009 (Leftin et al., 2011). Various factors such as income, the size of households, household head, and education that are correlated with the noncitizen status of the households might affect the program participation rates of households with noncitizens. The most obvious is the fact that households with noncitizens are much more likely to speak a language other than English at home.

I assume that the U.S. citizens are reasonably proficient in English. On the other hand, households with noncitizens would show various degrees of English proficiency because some of household members' first language can be a language other than English. For example, there can be a household with citizen children and noncitizen parents who speak a language other than English. There can also be a household with a noncitizen couple whose first language is not English and who have been in the United States. for just a few years. In these cases, adults in the households might have difficulty in applying for SNAP even though they are eligible for the program. Therefore, this thesis focuses on the effect of household members' language use and English proficiency on SNAP participation.

There is a large literature focusing on the socio-economic factors determining participation of individuals in SNAP, such as age (Haider et al. 2003), income (Blank and Ruggles, 1993; Farrell et al. 2003), ethnicity (Kaushal et al., 2014), marital status (Hagstrom, 1996), and lack of information (Daponte et al., 1999). Also, Moffitt (1983) derives a utility-maximizing model that demonstrates households' decision not to participate in a social security program resulting from stigma. This model can be applied to SNAP to explain low participation rates among the eligible households under the assumption that some disutility arises from participation in SNAP. Overall, previous studies imply that unobserved "transaction costs" of applying for SNAP is one of the fundamental factors determining if eligible households participate in the program.

Currie and Grogger (2001) suggest that efforts to increase the Food Stamp Program participation rate should focus on reducing transaction costs. Transaction costs include time spent learning knowledge of SNAP, the amount of time and energy to visit a local office, complete an application form, do an interview and recertify every 6 to 36 months, and the cost of enduring stigma attached to receiving SNAP benefits. If eligible households think that the total costs, both observed and unobserved, exceed the benefits from SNAP, they will decide not to participate in the program. For example, since physical abilities decline with age, it takes more time and energy for the elderly to apply for SNAP than the young while they have less needs for food assistance than the young. Thus, this partially explains why participation among the elderly is low.

This thesis hypothesizes that household members' English abilities affect the costs of applying for SNAP. To be specific, it would take more time for an individual whose

English ability is low to learn the information about SNAP and complete the application form. Also, non-native speakers would have difficulties in talking to an expert in a local office on the phone or doing an interview. Although there have been efforts such as providing extended office hours, application forms in other languages than English[1], and expert assistance to improve the SNAP application process, the costs of applying for SNAP of households with non-native speakers would be still higher than those of households with only native speakers. Therefore, I will examine the effect of household members' language use and English abilities on the program participation.

In the remainder of this thesis, I review the literature on SNAP in Section 2. Then, I present the data along with explanation for eligibility criteria for SNAP and measurement of households' language use in Section 3. In Section 4, I present the empirical framework and the identification strategy used to study the effect of household members' language use and English proficiency on SNAP participation. In Section 5, the descriptive statistics and empirical results are presented. Section 6 discusses limitations of the study and the meaning of empirical results. Section 7 concludes with discussion on policy implications and directions of future research.

[1] Each state has a different application process. 11 states provide an application form only in English. Other states provide an application form in English and Spanish, and 12 states among them also provide a paper form in additional languages other than English and Spanish.

2. Previous literature

The main purpose of SNAP is to provide nutrition assistance for low-income individuals and families. A large literature has tried to find whether SNAP participation reduces household food insecurity. However, since there are highly likely to be differences between participants and nonparticipants in a systematic way, identifying the causal relationship between SNAP participation and household food insecurity is complicated. That is, since households that are severely food insecure are more likely to participate in SNAP, there may seem to be an ostensibly positive association between SNAP participation and food insecurity, causing an endogeneity problem in standard econometric models. Wilde and Nord (2005) use the fixed effects approach to address the endogeneity from the self-selection of participants. They find that it reduces but does not completely eliminate the positive relationship between SNAP participation and food insecurity. Other studies address the endogeneity of SNAP participation using various methods, such as an instrumental variables approach, and find ameliorative effect of SNAP on food insecurity (Schmidt, Shore-Sheppard, and Watson, 2016; Kreider et al., 2012; Ratcliffe, McKernan, and Zhang, 2011; Nord, 2012; Mykerezi and Mills, 2010; Nord and Golla, 2009; Yen et al., 2008).

Besides affecting household food insecurity, SNAP may also affect household dietary quality because SNAP is closely related to participants' food choices. For example, Yen (2010) finds that SNAP participation has a small but negative effect on fiber intake. If participating in SNAP affected participants' dietary quality, it would eventually affect their physical and mental health. To be specific, many related studies have focused on

relations between SNAP participation and obesity even though their results vary. Some find that SNAP participation may help participants to have more healthful diets and better weight status (Nguyen et al., 2015; Burgstahler, 2012; Schmeiser, 2012). Others find that differences between SNAP participants and non-participants are not evident in their food choices and, therefore, in the odds of obesity (Almada et al., 2016; Leung et al., 2013; Fan, 2010; Kaushal, 2007). The others find a positive effect of SNAP on body weight and the odds of obesity (Leung et al., 2014; Baum, 2011; Leung and Villamor, 2011; Meyerhoefer and Pylypchuk, 2008; Chen et al, 2005).

Another strand of literature focuses on the relationship between SNAP participation and mental health. Leung et al. (2015) find that very high food insecurity is significantly associated with a higher possibility of depression among both SNAP participants and eligible non-participants, but the correlation is higher among eligible non-participants than among SNAP participants. That is, the relations between mental health and food insecurity may vary based on SNAP participation status. However, Heflin and Ziliak (2008) find that the negative mental health aspects of FSP participation seem to outweigh the positive mental health aspects.

A number of researchers have also tried to find the factors determining participation of individuals in SNAP. Especially, many of them focus on demographic factors. For example, Haider et al. (2003) find that FSP participation rates decline with age. The thesis shows that the declining participation with the age cannot be explained by measurement error. They conclude that the elderly appears less likely to need food assistance than the young. Kaushal et al. (2014) study the factors related to SNAP participation among

Mexican immigrant families. They used the Current Population Survey – Food Security Supplement (CPS-FSS) because it provides detailed information on household members' country of birth and citizenship status as well as food insecurity. Their analysis with the fixed effects model shows that Mexican immigrant households tend not to participate in SNAP even though they are more likely to be food insecure than native households. They attribute fear of deportation of the undocumented family members as an important factor of their SNAP participation decision.

There are many different data sources used for SNAP related research. The Survey of Income and Program Participation (SIPP) are often used in studies on determinants of SNAP participation because it contains comprehensive information about income and program participation of households as well as their demographic characteristics. For instance, Blank and Ruggles (1993) compare spells of eligibility for FSP with spells of participation using the SIPP. They use the SIPP not only because it provides monthly information, but because it also collects detailed income information including public assistance income categories that help to calculate precise eligibility for FSP. They find that women with lower long-term earnings are most likely to participate in the Aid to Families with Dependent Children (AFDC) and FSP. Farrell et al. (2003) also use SIPP for the same reasons as Blank and Ruggles (1993). They use both logit analysis and instrumental variable (IV) approach to examine the effect of expected long-term income of a household on FSP participation decision. Specifically, past and future income values are used as instrumental variables (IVs). Using the IV methods, they find that non-participants who are eligible for FSP tend to have relatively short eligibility spells. That is, households

with lower long-term incomes and earnings appear to be more likely to participate in FSP, while households with temporarily low incomes and earnings do not participate in the program. Similarly, Hagstrom (1996) uses the logit model estimation with the SIPP. Their finding shows that households with a married couple are more likely to participate in FSP as the food stamp benefit increases or the food stamp benefit reduction rate decreases.

Besides demographic characteristics of households, some studies focus on other factors leading to higher transaction costs such as accessibility of information about SNAP or social stigma of participating in the program. Daponte et al. (1999) find that a lack of information about FSP leads to low participation rates of the eligible. In addition, they mention that a large proportion of the eligible households that expect only modest benefits do not participate in the FSP because costs of enrolling in the program would be higher than benefits from it. Therefore, provision of information would reduce one of the costs of participating in FSP and lead to a higher take-up of FSP benefits. Also, Moffitt (1983) shows that stigma associated with receiving food stamps keeps eligible households with positive benefits from participating in the FSP based on an economic model of welfare stigma.

3. Data

The primary source of data used for my analysis is the 2008 panel of the SIPP by the U.S. Census Bureau. The SIPP is a longitudinal survey that contains comprehensive information about income and government program participation of households in the

United States. It also provides topical content that covers diverse issues such as demographics, assets, food security and health care. It consists of 16 waves and 4 reference months in each wave covering survey months of September 2008 – December 2013. That is, the entire sample is surveyed in intervals of four months. Each group of interviews is called a wave that includes core questions and topical questions. Core questions are asked in each wave and topical questions vary with the wave. I use fourth reference months of the wave 4, wave 7, and wave 10, because they contain essential information to establish eligibility such as information about assets, liabilities, dependent care, and medical expenses.[2]

The SNAP eligibility is established based on the eligibility requirements by the USDA Food and Nutrition Service (FNS). For example, a household must pass certain tests such as a resource test[3] and income tests[4] to be eligible. One advantage of the SIPP is that it contains most information needed to calculate the eligibility of each household.

[2] Other waves and reference months are used to calculate a long-term income of each household which is the average of incomes for the 12 months around the reference month, 6 months before the reference month and 5 months after the reference month.

[3] Whether or not households that have no more than $2,250 in countable resources or $3,500 in countable resources if at least one household member is 60 years of age or older, or is disabled. There are resources that are not counted, such as the resources from Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), and retirement/pension plans. Vehicle values that are counted as resources depend on vehicle rules in each state. For example, vehicle rules in 32 states exclude the entire value of all vehicles and in 21 states exclude the value of at least one vehicle per household.

[4] To qualify for SNAP, there are two income tests for a household to meet. One is that the gross monthly income of a household must not be more than 130 percent of poverty, and the other is that the net monthly income must not be more than 100 percent of poverty. A household whose members receive TANF, SSI, or some other assistance does not have to pass income tests. Also, a household with at least one member who is 60 years of age or older, or is disabled only has to pass the net income test.

Especially, more detailed information about diverse payments is needed to follow the net income calculation by USDA FNS, such as dependent care, medical expenses for elderly and disabled members, utility costs, rent or mortgage payments, and taxes on the home. Since the information for the net income test was collected by the topical questions in fourth reference months in wave 4, wave 7, and wave 10, I use only the information of these months in the three waves to establish the eligibility of households as accurate as possible.[5] The intervals between wave 4 and wave 7, and wave 10 are exactly one year.

The SIPP collects household members' language use through two questions. The first question asks if each household member speak a language other than English at home. For individuals who speak a language other than English at home and are aged 5 or over, the second question asks the ability to speak English. The answers to the second question are categorized by four levels of proficiency. Since those who speak English at home do not answer the second question, I assume that their level of English proficiency is the highest level, "very well". Also, since a SNAP participation decision is made at the household level, the level of English proficiency of households is determined based on the highest level of English proficiency among household members of 18 and above.

[5] Following Gundersen and Oliveira (2001), I drop some observations. First, observations with incomplete records of variables for eligibility calculation are deleted. Second, households in Alaska, Hawaii, Idaho, Montana, or Wyoming are deleted. This is because SNAP benefits in Hawaii and Alaska are higher than benefits in other states, and Alaska is identified jointly with Idaho, Montana, and Wyoming in SIPP to protect confidentiality and thus households in these states cannot be identified separately. Third, households with negative incomes are deleted. Lastly, individuals who receive SSI in California are deleted because they are not eligible for SNAP.

In order to examine the effect of households' language use and English ability on SNAP, I consider only eligible households for SNAP for analysis. Thus, the data used in this study is unbalanced because some households that are eligible for SNAP in a wave may not eligible in another wave based on the eligibility requirements. Table 2 shows how households are consistent in their English proficiency according to the categorical measures and their language use at home during their eligible periods for SNAP. During the waves eligible for SNAP, 98.1% (1,774 households among 1,808 households) stayed at their English proficiency level and 99.9% (1,807 households among 1,808 households) maintained their language use at home (either English or non-English).

4. Empirical framework

The basic equation in this thesis is

$$y_{it} = \boldsymbol{x}_{it}'\boldsymbol{\beta} + \boldsymbol{z}_i'\boldsymbol{\alpha} + \varepsilon_{it} \quad (1)$$

$$= \boldsymbol{x}_{it}'\boldsymbol{\beta} + c_i + \varepsilon_{it} \quad (2)$$

where $\boldsymbol{x}_{it}$ is a vector of regressors of household i at time period t that does not include a constant term; $\boldsymbol{z}_i$ is a vector of variables that includes a constant term and group-specific variables of household i; $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are parameters to be estimated; ε_{it} is a random disturbance of household i at time period t; c_i represents $\boldsymbol{z}_i'\boldsymbol{\alpha}$. The household-specific variables may be observed or unobserved. Table 3 shows the variables included in the

equation (2) and the following equations in this section. One of the notable points is that each model includes the expected SNAP benefit that is calculated based on available information as well as other variables that are used to calculate the expected SNAP benefit.[6]

The equation (2) can be rewritten as the pooled model:

$$y_{it} = \boldsymbol{x}_{\boldsymbol{it}}'\boldsymbol{\beta} + c + (c_i - c + \varepsilon_{it}) \tag{3}$$

where c represents $E[\boldsymbol{z}_{\boldsymbol{i}}'\boldsymbol{\alpha}]$.

If $\boldsymbol{z}_{\boldsymbol{i}}$ in the equation (1) contains only a constant term, that is, if the equation (3) explicitly includes a common intercept, then individual or group-specific effects $(c_i - c)$ are centered on zero. Assuming that any latent heterogeneity has been averaged out, pooled FGLS or population-averaged estimation can lead to estimators of the parameters of the equation (3) that are more efficient than simple OLS estimation (Cameron et al., 2009). Consistency of OLS requires that the error term $(c_i - c + \varepsilon_{it})$ be uncorrelated with $\boldsymbol{x}_{\boldsymbol{it}}$.

However, if $\boldsymbol{z}_{\boldsymbol{i}}$ in the equation (1) is unobserved, but correlated with $\boldsymbol{x}_{\boldsymbol{it}}$, then the least squared estimator of $\boldsymbol{\beta}$ is biased and inconsistent because of an omitted variable. In a general form,

$$E[c_i|\boldsymbol{X}_{\boldsymbol{i}}] = h(\boldsymbol{X}_{\boldsymbol{i}}) \tag{4}$$

[6] When regressing the expected SNAP benefit on monthly household income or long-term household income, each R-squared (R^2) value is 0.17 and 0.09, respectively. Also, when regressing the expected SNAP benefit on each income variable and other variables in the models that are used to calculate the benefit, each R-squared (R^2) value becomes 0.35 and 0.27, respectively.

Because the conditional mean is the same in every period, I can write the equation (2) as

$$y_{it} = \boldsymbol{x}_{\boldsymbol{it}}'\boldsymbol{\beta} + h(\boldsymbol{X}_{\boldsymbol{i}}) + \varepsilon_{it} + [c_i - h(\boldsymbol{X}_{\boldsymbol{i}})]$$
$$= \boldsymbol{x}_{\boldsymbol{it}}'\boldsymbol{\beta} + \alpha_i \quad + \varepsilon_{it} + [c_i - h(\boldsymbol{X}_{\boldsymbol{i}})]$$

where α_i represents $h(\boldsymbol{X}_{\boldsymbol{i}})$.

By construction, the bracketed term is uncorrelated with $\boldsymbol{X}_{\boldsymbol{i}}$, so it may be absorbed in the error term, then I can rewrite the equation as

$$y_{it} = \boldsymbol{x}_{\boldsymbol{it}}'\boldsymbol{\beta} + \alpha_i + \varepsilon_{it} \tag{5}$$

Assuming $Var[c_i|\boldsymbol{X}_{\boldsymbol{i}}]$ is constant, the equation (5) becomes a classical linear regression model. That is, this fixed effect approach takes α_i to be a household-specific constant term in the regression model. Then the fixed effects formulation implies that differences across households can be captured in differences in the constant term.

Lastly, if the group-specific constant term is strictly uncorrelated with other covariates, then, the random effects model is formulated as:

$$y_{it} = \boldsymbol{x}_{\boldsymbol{it}}'\boldsymbol{\beta} + (\alpha + u_i) + \varepsilon_{it} \tag{6}$$

In this model, the constant term is the mean of the unobserved heterogeneity, $E[z_i'\alpha]$. u_i is the individual specific, random heterogeneity, $z_i'\alpha - E[z_i'\alpha]$.

In this thesis, I use the population-averaged estimation model (3) to estimate the effect of a household's English proficiency on SNAP participation decision. The model is used under the assumptions of a classical model such as zero conditional mean of ε_{it}, homoscedasticity, independence across observations, i, and strict exogeneity of $\boldsymbol{x_{it}}$. Also, I use both the population-averaged estimation model (3) and the random effects model (6) to estimate the effect of a language spoken at home on SNAP participation decision. The random effects model is used under the assumption that the omitted effects, c_i, in the equation (2) are uncorrelated with the regressors.

Identification strategy

This thesis tries to answer two main questions. First, does using a first language other than English itself (as a dichotomous measure) affect their SNAP participation decision? If so, considering variations in their English proficiency levels among non-citizen households, does a household member's English proficiency (as a categorical measure) affect the household's SNAP participation decision? Among the survey questions in the SIPP, there are several questions about respondents' English use. One of them asks if a respondent speaks a language other than English at home. I consider those who answer "Yes" to the question as people whose first language is not English. For those who answer "Yes" to the first question, there is a follow-up question asking how well the respondent speaks English. Those who answer "No" to the first question speak only English at home, so I assume that they speak English "Very well" even though they don't answer the latter question. Since the eligibility for SNAP is determined at the household level, household

members' English proficiency needs to be converted to English proficiency of each household. To measure English proficiency of a household, I assume that the highest level of English proficiency among household members aged 18 and older is the English proficiency of the household.

There are three sources of statistical endogeneity. First, reverse causality or simultaneity would arise when the regressor causes the dependent variable, but the dependent variable also causes the regressor. In other words, the expectation of the dependent variable may cause households to adjust the regressor consequently. The second source is unobserved heterogeneity or omitted variables, which is the main source of statistical endogeneity. Most of individuals' preferences are not observed and these unobserved variables are highly likely to be correlated with observed variables. The last source is measurement error. When a regressor of interest is systematically mismeasured, the degree of mismeasurement is correlated with the regressor.

(i) Reverse causality or simultaneity

I hypothesize that if household members are less proficient in English, their transaction costs of SNAP participation are higher than those who are more proficient in English. However, it is hard to imagine that SNAP participation would affect household members' English proficiency who are aged 18 and older. Participating in SNAP guarantees them some amounts of vouchers that can be used to purchase food. It might be plausible that children who are provided enough nourishment learns English faster than those who aren't, but English proficiency of households considers only adult members'

English proficiency. Therefore, I expect that reverse causality is not a problem in the short run. Similarly, it is hard to think that SNAP participation would affect recipients' first language.

(ii) Unobserved heterogeneity or omitted variables

Using three waves of panel data with one-year interval, the pooled averaged estimation model is used to estimate the effect of households' English proficiency on SNAP participation in this thesis. However, it does not resolve unobserved heterogeneity issues. One possible solution is the fixed effects model estimation. By using the fixed effects model, consistent estimation is possible with endogenous regressors provided that they are correlated only with the time-constant component of the disturbance and not with the time-varying component of the disturbance. Therefore, it partially solves problems of unobserved variables. However, since the fixed effects model does not capture the effects of time-invariant variables, it cannot be applied to estimate the effect of households' English proficiency that is almost time-invariant (Table 2).

Another solution for the omitted variables problem is finding instruments or proxies for the unobserved variables. However, it is challenging to find appropriate instruments because they need to meet strong assumptions. First, instrumental variables must be correlated with the regressor. Second, they must be uncorrelated with the disturbance in the second stage. In other words, instrumental variables must affect the dependent variable only through the independent variable. One candidate for an instrumental variable is whether any part of the interview for the SIPP was conducted in a language other than

English because it may be highly correlated with English use and proficiency of the households and it is highly likely to affect their SNAP participation decision only through their English use and proficiency. The survey questionnaire asks the question, but the information is not available in the datasets used in this thesis. Thus, I leave it as a limitation of this thesis.

Similarly, the fixed effects model cannot be used to estimate the effects of a non-English first language on SNAP participation because the first language of a household hardly changes over time (Table 2). For this reason, the random effects model is considered as an alternative although it needs a strong assumption that the unobserved variables are uncorrelated with all the observed variables. To test whether the model is appropriate to be used, several methods, such as Lagrange multiplier test, Hausman's specification test, and Mundlak's approach (Mundlak, 1978) are suggested (Greene, 2011). If the fixed effects model turned out to be the preferred specification for these data based on the tests, the pooled regression model and the random effects model would be used leaving unobserved heterogeneity unsolved.

(iii) Measurement error

Daponte et al. (1999) study why the eligible low-income households do not participate in FSP. They find out that many papers derive the program eligibility of households from their dataset, but in fact, many households that appear to be eligible are not eligible. This happens because of incomplete and also inaccurate information of the data used. This thesis uses SIPP that contains almost all the components needed to calculate

the program eligibility. Although the information is collected by respondents' self-reporting, I use all available information when deriving their eligibility to minimize the possibility of misclassification.

Household members' English proficiency is measured in four levels by their self-reporting. Since the information is self-reported, it is not likely for the interviewees to measure their English proficiency precisely. Also, household members' English proficiency needs to be converted to English proficiency of the household because SNAP participation is determined by household level. English proficiency of a household is determined by the highest level of English proficiency among the members. In the conversion process, the severity of measurement error in English proficiency may increase because even one member's misreporting affects the entire household information. Therefore, there may be a limitation in the estimation because of the endogeneity caused by measurement error.

5. Descriptive statistics and estimation results

Descriptive statistics

Table 4 shows descriptive statistics for the selected variables. The values are derived using the fourth reference months of wave 4, wave 7, and wave 10.[7] The SNAP

[7] Wave 4, wave 7, and wave 10 are the 2009 panel, the 2010 panel, and the 2011 panel, respectively.

participation rate among the eligible households is 62%.[8] The average expected SNAP benefit is $327.16 for all eligible households, $301.84 for participants, and $368.19 for non-participants.[9] Since SNAP benefits are likely to increase as net income decreases, higher average expected SNAP benefit for non-participants may mean that poorer eligible households did not participate in SNAP. The average actual SNAP benefit is $402.38 for participants.[10] There are gaps between the average expected SNAP benefits for participants and the average actual SNAP benefits. It might be caused by incomplete information in the dataset used to calculate the expected SNAP benefits. The average long-term household income is $2,383.11 for all eligible households, $2,410.94 for participants, and $2,338.03 for non-participants.[11] Blank and Ruggles (1993) and Farrell et al. (2003) find that households with lower long-term earnings or incomes are more likely to participate in FSP. However, among households eligible for SNAP, the non-participants' average long-term household income is lower than that of participants. To see the pure effect of household incomes, there are other factors that should be controlled such as household size. The average household size of participants is bigger than that of non-participants. The average number of kids of participants is also greater than that of non-participants and the average youngest kid's age is younger than that of non-participants. The proportion of households who pay rent for housing is much larger for participants compared to eligible non-

[8] The SNAP participation rate is 61.3% in 2009, 61.2% in 2010, and 62.9% in 2011 separately.
[9] Expected SNAP benefits are calculated based on the computation process provided by USDA using the information of SIPP.
[10] Actual SNAP benefits are based on the reported SNAP benefits in SIPP.
[11] A long-term household income is an average of household incomes for 12 months, 6 months prior to the reference month and 5 months subsequent to the reference month.

participants, 62.0% of participants who pay rent and 38.3% of non-participants who pay rent.

The proportions of each category of household English proficiency do not seem to vary significantly between participants and eligible non-participants. However, 30% of participants speak a language other than English at home while 40% of eligible non-participants do. That is, the proportion of households whose members are non-native English speakers is larger for eligible non-participants compared to participants. Furthermore, participating households consist of 63.9% of white households, 28.8% of black households, 2.3% of Asian households, and 5.1% of others; non-participating households consist of 78.7% of white households, 13.2% of black households, 4.1% of Asian households, and 4.1% of others. It seems that households whose members speak English as a first language are more likely to participate in SNAP. However, the high participation rates of black households might have affected the participation rates of households with native English speakers. That is, if black American households are more likely to participate in SNAP than non-black American households, it would lead to high participation rates of households whose members speak English as a first language. Also, 26.8% of SNAP participants are Hispanic households, and 33.5% of eligible non-participants are Hispanic households.

The proportion of households with at least one disabled person is more than double for participants compared to non-participants, 36.1% of participants with at least one disabled household member and 16.6% of non-participants. The proportion of households with at least one elderly person is also higher for participants than for non-participants,

12.9% and 7.2%, respectively. 53.3% of participating households are female headed and 26.8% of non-participating households are female-headed. 41% of participants are married households and 69% of non-participants are married households.

Estimation results

In the following, first I examine the effect of household English proficiency on SNAP participation, and then I examine the effect of speaking English as a first language on SNAP participation. Since Table 4 shows no significant differences in household English proficiency between participating and eligible non-participating groups, it seems hard to expect significant results from the first estimation. As discussed in Identification Strategy Section, the fixed effects model cannot be used to estimate the effect of households' English proficiency on SNAP participation because English proficiency levels of the households do not vary over time and the fixed effects estimation partial out time-invariant variables. Thus, it is natural to start with a pooled OLS estimation for SNAP participation. Regressing SNAP participation on households' English proficiency and other regressors would yield consistent estimates of β if the composite error (u_{it}) in the pooled model is uncorrelated with regressors. Since the error is likely to be correlated over time for a given household (within correlation), cluster-robust standard errors that cluster on the household are used.

Table 5 shows the results. Columns 1 to 3 show the results when including long-term household incomes as an indicator of welfare and Columns 4 to 6 show the results when including monthly household incomes. Some of the statistically significant results in Table

5 are notable. Every $100 increase in SNAP benefits is associated with 1% decrease in the likelihood that the household decides to participate in SNAP (Column 3). Also, every $1,000 increase in household incomes is associated with 1.3% increase in the likelihood that the household decides to participate in SNAP (Column 6). These results correspond to the fact in Table 4 that the participants' average household incomes are higher than those of eligible non-participants and the participants' average expected SNAP benefits are lower than those of non-participants. Every additional kid is associated with 5.1% increase and 4.7% increase in the likelihood that the household participates in SNAP when including long-term total incomes and total incomes respectively (Columns 3 and 6). Households with at least one disabled member are around 12% more likely to participate in SNAP. Married households are 11% less likely to participate in SNAP. Before controlling ethnicity factors, it seems that English proficiency of a household is associated with its SNAP participation decision. However, when ethnicity controls are included in the model, the results do not show any significant relations between household English proficiency and SNAP participation decision (Column 3 and Column 6).

Table 6 presents the pooled averaged estimation results for a language spoken at home. Columns 1 to 3 show the results when including long-term total incomes as an indicator of welfare and Columns 4 to 6 show the results when including total incomes. In Columns 1, 2, 4, and 5, households whose members speak English as the first language are more likely to participate in SNAP before controlling race. To be specific, households speaking English at home are 8% more likely to participate in SNAP (Columns 2 and 5). Every $1,000 increase in long-term total incomes is associated with a 0.7% increase in the

likelihood that the household decides to participate in SNAP (Column 3). Column 3 also shows that every $100 increase in SNAP benefits is associated with a 1% decrease in the likelihood that the household decides to participate in SNAP. When including total incomes instead of long-term total incomes, every $1,000 increase in total incomes is associated with a 1.3% increase in SNAP participation rates (Column 6). Households paying rent are 14% more likely to participate in SNAP (Column 3 and 6). Every additional kid is associated with a 5% increase in the likelihood that the household participates in SNAP (Column 3 and 6). Households with at least one disabled member are 11% more likely to participate in SNAP and married households are 11% less likely to participate in SNAP.

I also examine the effect of the language spoken at home on SNAP participation using the random effects model because it can include time-invariant variables. However, the random effects model requires the unobserved variables to be uncorrelated with all the observed variables, which often turns out to be a wrong assumption. To test whether using the random effects model is appropriate, I use a Hausman test where the null hypothesis is that the individual effects are random and, therefore, the preferred model is random effects model. This test of random effects against fixed effects yields the overall statistics, $p = 0.0001$ when including either long-term household incomes or monthly household incomes, which leads to strong rejection of the null hypothesis. Therefore, the fixed effects model is preferred to the random effects model based on the test. In other words, the random estimator is likely to provide inconsistent estimates. I also test random effects by the Breusch-Pagan Lagrange Multiplier (LM) test where the null hypothesis is that the variance of random effects is zero. This test of the random effects model against the pooled

OLS model yields the overall statistics, p=0.0000 when including either long-term household incomes or monthly household incomes, which leads to strong rejection of the null hypothesis. This is evidence of significant differences across households, therefore using the random effects model is more appropriate than using the pooled OLS model despite of the Hausman test result.

Table 7 presents the random effects model estimation results for a language spoken at home. Columns 1 to 3 show the results when including long-term household incomes as an indicator of welfare and Columns 4 to 6 show the results when including monthly household incomes. All columns show that households whose members speak English at home are more likely to participate in SNAP. To be specific, when controlling income, SNAP benefit, housing ownership, child information (Column 1 and 4), they are 11% more likely to participate in SNAP. This number decreases to 5% and the level of statistical significance weakens as more controls are included in the model (Column 2, 3, 5, and 6). Also, every $1,000 increase in monthly household incomes is associated with 2% increase in the likelihood that the household decides to participate in SNAP (Column 4, 5, and 6). The amount of SNAP benefits, the youngest kid's age, and marital status of a household are negatively related to the SNAP participation decision of the household. On the other hand, ownership status of living quarters, the number of children, and female head are positively related to SNAP participation. Households with at least one disabled or elderly member are more likely to participate in SNAP. Lastly, black households are 10% more likely to participate in the program.

6. Discussion

Before interpreting the results in Section 5, there are several limitations to be considered in this study. First, there is an issue about measurement errors in the SNAP eligibility and benefit of households. In Table 1, the SNAP participation rate in 2009 is higher than 70%. However, Table 4 shows that the average participation rate calculated with the Wave 4, 7, and 10 in SIPP that were collected in 2009, 2010, and 2011 is 62%. Meyer, Mok and Sullivan (2009) provide evidence of a systematic underreporting of SNAP participation in SIPP. Furthermore, the amount of the reported average SNAP benefit in SIPP is larger than that of the calculated average SNAP benefit among participants ($402.4 and $301.8, respectively). There are two sources of measurement errors. One is incomplete information of SIPP. That is, there is missing information needed to calculate the households' SNAP benefit precisely such as taxes and detailed vehicle information. The other is the possibility of respondents' misreporting of core information including information needed to calculate respondents' eligibility for SNAP and the amount of benefit as well as SNAP participation decision. Bollinger and David (1997) point out that when aggregating individual responses to the household level, 12% of responses are errors of omission and 0.32% of responses are errors of commission.[12] The misreporting might be caused by their imperfect memory. If that is not the case, respondents would misreport intentionally for some reasons. For example, they may feel ashamed of reporting SNAP participation.

[12] Errors of omission are errors caused by not reporting benefits actually received and errors of commission are errors caused by reporting benefits not actually received.

Secondly, Table 4 shows little difference in household English proficiency among SNAP participants and eligible non-participants. More than 80% of households reported at least one adult member speaks English "very well", and around 2% of responded "Not at all". As expected, Table 5 shows that the estimated coefficients of household English proficiency are not statistically significant. A plausible explanation is that the measurement of English proficiency is not reliable. Since English proficiency was measured by respondents' self-reporting, it is quite probable for them to misreport their English proficiency.[13] Even though the effect of household English proficiency on SNAP participation is not identified in this thesis, it would be worthwhile studying it in future research using more reliable measurement of English proficiency such as a test score. Alternatively, this thesis studies the effect of a language spoken at home on SNAP participation because it can be used as a proxy for household members' first language. Specifically, whether they speak a language other than English at home was asked in the survey.

Thirdly, the empirical models in Section 4 may not solve the endogeneity problems. Specifically, since the dependent variables of interest in this thesis are time-invariant, the fixed effects model can't be used to capture time-invariant unobserved variables. Alternatively, the random effects model is used, but it needs a strong assumption that the

[13] In order to reduce the measurement error of households' English proficiency, a simplified binary variable is developed to categorize the first two levels ("Not at all" and "Not well") as "Not well" and the other two levels ("Well" and "Very well") as "Well". Even when using the new variable instead of the existing variable, estimation results do not show any significant relations between household English proficiency and SNAP participation decision.

unobserved variables are uncorrelated with all the observed variables. This assumption could be tenuous with the observational data. Therefore, it is highly likely that the random effects model doesn't solve the endogeneity problem and thus the random estimator provides inconsistent estimators. One solution for the omitted variables problem is finding instruments for the unobserved variables although it is difficult to find IVs because they need to meet strong assumptions. In this thesis, I fail to find appropriate instruments, so I leave it as a major limitation.

Despite of several limitations, it would be worthwhile interpreting the estimation results. Above all, households speaking English at home are 5.1% more likely to participate in SNAP. The race variable may affect both household members' language use and SNAP participation. For example, Kaushal et al. (2014) finds that Mexican immigrant families are less likely to participate in SNAP. However, even after controlling the household members' race, the effect of a language spoken at home on SNAP participation is statistically significant. Also, black households are 9.7% more likely to participate in SNAP than white households.

One surprising finding is that eligible households that earn more incomes and expect less SNAP benefits are more likely to participate in SNAP. Table 4 shows that the average monthly household incomes of participants are higher than those of eligible non-participants. This result doesn't correspond to previous findings (Farrell et al., 2003; Hagstrom, 1996; Blank and Ruggles, 1993) and it is also counter-intuitive because households with lower incomes have a strong incentive to participate in SNAP because they are more likely to be food insecure than households with higher incomes. One possible

explanation is that there might be an incentive for low-income households to misreport their SNAP participation. For example, the poorer a household is, the more they are likely to feel ashamed of reporting SNAP participation for some reasons such as social stigma. Another possibility is that there might be confounding factors affecting both incomes and SNAP participation. Most of other statistically significant results in Table 7 are not surprising.

7. Conclusion

Households with at least one noncitizen is less likely to participate in SNAP when they are eligible for the program. One of many factors determining their SNAP participation may be household members' language use and English proficiency. That is, this thesis hypothesizes that household members' English abilities affect the costs of applying for SNAP, so their SNAP participation decision. Using the SIPP by the US Census Bureau, this thesis finds that households whose members speak English at home are 5% more likely to participate in SNAP. However, it finds that there is no statistical significance in household members' English proficiency when controlling socio-demographic variables. Also, the results show that black households are 10% more likely to participate in the program. Interestingly, more household incomes and less SNAP benefits seem positively related to the SNAP participation decision. This might be caused by low-income households' misreporting of the SNAP participation. Another possibility is that there might be confounding factors affecting both incomes and SNAP participation.

Implications for policy could be pertinent to the accessibility of SNAP. The impact of a household's language use on its SNAP participation decision suggests that current policies that provide extended office hours, application forms in other languages than English, and expert assistance to improve the SNAP application process have positive impact on the SNAP participation rates. However, since there are still considerable differences of the SNAP participation rates between eligible native households and non-native households, and the findings of this show a statistically significant association of a household's language use at home with its SNAP participation decision, policies supporting the eligible non-native households would likely help increase their SNAP participation.

Table 1. Number of Eligible and Participating Individuals and Households, and Participation Rates (1976 – 2009)

	Eligible (000s)		Participating (000s)		Participation Rates (%)	
Year	Individuals	Households	Individuals	Households	Individuals	Households
Sep. 1976	50,061	16,282	15,880	5,308	31.7%	32.6%
Feb. 1978	40,175	13,984	15,387	5,286	38.3%	37.8%
Aug. 1980	36,567	14,042	20,185	7,372	55.2%	52.5%
Aug. 1982	39,364	14,538	20,548	7,487	52.2%	51.5%
Aug. 1984	38,591	14,194	19,990	7,324	51.8%	51.6%
Aug. 1986	40,061	15,273	19,069	7,102	47.6%	46.5%
Aug. 1988	38,166	14,896	18,358	7,016	48.1%	47.1%
Aug. 1990	37,631	14,523	20,396	7,973	54.2%	54.9%
Aug. 1991	40,989	15,574	23,364	9,204	57.0%	59.1%
Aug. 1992	43,474	16,627	25,759	10,238	59.3%	61.6%
Aug. 1993	45,241	17,031	27,260	10,900	60.3%	64.0%
Aug. 1994	44,327	17,040	27,207	11,005	61.4%	64.6%
Sep. 1994	35,053	15,305	26,229	10,659	74.8%	69.6%
Sep. 1995	34,665	14,994	25,213	10,374	72.7%	69.2%
Sep. 1996	34,478	15,264	23,874	9,934	69.2%	65.1%
Sep. 1997	31,818	14,692	20,365	8,446	64.0%	57.5%
Sep. 1998	30,350	14,024	18,152	7,606	59.8%	54.2%
Sep. 1999	29,502	13,723	17,081	7,280	57.9%	53.0%
FY 1999	30,857	14,508	17,705	7,481	57.4%	51.6%
FY 2000	29,458	14,235	16,701	7,146	56.7%	50.2%
FY 2001	31,223	15,107	16,834	7,250	53.9%	48.0%
FY 2002	34,182	15,989	18,478	7,954	54.1%	49.7%
FY 2003	36,462	17,070	20,577	8,892	56.4%	52.1%
FY 2004	37,342	17,489	23,090	9,991	61.8%	57.1%
FY 2005	37,745	17,727	24,510	10,737	64.9%	60.6%
FY 2006	36,460	17,124	25,136	11,186	68.9%	65.3%
FY 2007	37,167	17,454	25,461	11,427	68.5%	65.5%
FY 2008	38,575	17,985	27,229	12,297	70.6%	68.4%
FY 2009	44,512	20,330	32,146	14,685	72.2%	72.2%

Source: Leftin, J., Eslami, E., and Strayer, M. (2011). Trends in Supplemental Nutrition Assistance Program Participation Rates: Fiscal Year 2002 to Fiscal Year 2009, United States Department of Agriculture Food and Nutrition Service.

Notes: Participant and eligibility totals represent monthly averages.

Table 2. Consistency in categorical measures of English proficiency and dichotomous measures of language use at home during households' eligible periods for SNAP

Eligible for SNAP for:	Number of households	Consistent during eligible periods in:	
		English proficiency	Language use at home
1 wave	470	470	470
2 waves	355	350	355
3 waves	983	954	982
Total	1,808	1,774	1,807

Notes: The data used in this study is unbalanced because this thesis considers only eligible households for SNAP for analysis. In other words, some households that are eligible for SNAP in a wave may not eligible in another wave based on the eligible requirements. The number of households that are eligible for one wave (among three waves) is 470, for two waves is 983, and for three waves is 355.

Table 3. Summary of variables of the study

	Variables	Operationalization
Dep. Var.	SNAP participation	Dummy – 1 if the household participates in SNAP; 0 otherwise
Indep. Var.	Household English proficiency	Continuous – 1 if the household speaks English "not at all"; 4 if "very well"
	English use at home	Dummy – 1 if the household speak English at home; 0 otherwise
Control	Monthly household income	Monthly total income of the household ($1,000s)
	Long-term household income	The household's average monthly total income for 12 months ($1,000s)
	SNAP benefit	Calculated amount of the household's SNAP benefits ($1,000s)
	Rental payment	Dummy – 1 if the household's living quarter is rented; 0 otherwise
	Number of children	Continuous
	The youngest child's age	Continuous – the youngest child's age in the household
	Household disability	Dummy – 1 if there is at least one disabled member in the household; 0 otherwise
	Household elderly	Dummy – 1 if there is at least one elderly member in the household; 0 otherwise
	Female-headed household	Dummy – 1 if the household's head is female; 0 otherwise
	Marital status	Dummy – 1 if the household is married; 0 otherwise
	Race	Categorical – 1 if the household is white only; 2 if Black only; 3 if Asian only; 4 if residual
	Hispanic	Dummy – 1 if the household is Hispanic; 0 otherwise

Notes: A long-term household income is an average of monthly household incomes for 12 months, 6 months prior to the reference month and 5 months subsequent to the reference month.

Table 4. Means and Standard Deviations of Selected Variables for SNAP Participation

Variable	All eligible households	Participants	Non-participants
Food stamp recipient	1.00	0.62	0.38
Expected benefit ($)	327.16	301.84	368.19
	(254.88)	(266.84)	(227.90)
Actual benefit ($)	248.79	402.38	
	(274.52)	(245.11)	
Monthly household income ($)	2133.96	2408.66	1688.95
	(2755.64)	(3396.53)	(942.97)
Long-term household income	2383.11	2410.94	2338.03
($)	(2542.93)	(2977.63)	(1605.88)
Household size	4.39	4.42	4.32
	(1.63)	(1.69)	(1.53)
Number of kids	2.26	2.31	2.18
	(1.19)	(1.21)	(1.16)
The youngest kids age	6.64	6.44	6.97
	(4.65)	(4.62)	(4.69)
Household English proficiency			
Not at all	0.022	0.021	0.023
Not well	0.076	0.070	0.085
Well	0.064	0.053	0.080
Very well	0.849	0.856	0.812
Language spoken at home			
English	0.66	0.70	0.60
Non-English	0.34	0.30	0.40
Paying rent			
No	0.471	0.380	0.617
Yes	0.529	0.620	0.383
Household disability			
Non-disabled	0.714	0.639	0.834
Disabled	0.287	0.361	0.166
Household elderly			
Non-elderly	0.893	0.871	0.928
Elderly	0.107	0.129	0.072
Household head			
Male-headed	0.568	0.467	0.732
Female-headed	0.432	0.533	0.268
Marital status			
Non-Married	0.483	0.590	0.310
Married	0.517	0.410	0.690
Race			
White only	0.695	0.639	0.787
Black only	0.228	0.288	0.132
Asian only	0.030	0.023	0.041
Residual	0.047	0.051	0.041
Hispanic			
Non-hispanic	0.707	0.732	0.665
Hispanic	0.294	0.268	0.335
Number of households	4129	2553	1576

Table 5. The Pooled Regression Model Estimation results for household English proficiency

VARIABLES	(1)		(2)		(3)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.061***	(0.02)	0.040**	(0.02)	0.023	(0.02)
Monthly household income ($1,000)						
Long-term household income ($1,000)	0.006**	(0.00)	0.007**	(0.00)	0.007**	(0.00)
SNAP benefit ($1,000)	-0.120***	(0.04)	-0.101***	(0.04)	-0.099***	(0.04)
Paying rent	0.169***	(0.03)	0.138***	(0.03)	0.138***	(0.03)
Number of kids	0.044***	(0.01)	0.050***	(0.01)	0.051***	(0.01)
The youngest kid's age	-0.001	(0.00)	-0.004*	(0.00)	-0.004*	(0.00)
Household disability			0.121***	(0.02)	0.116***	(0.02)
Household elderly			0.046	(0.03)	0.043	(0.04)
Female household head			0.052	(0.04)	0.044	(0.04)
Married			-0.118***	(0.04)	-0.111***	(0.04)
Race						
Black only					0.035	(0.03)
Asian only					-0.007	(0.07)
Residual					0.01	(0.05)
Hispanic					-0.056*	(0.03)
Intercept	0.337***	(0.08)	0.411***	(0.08)	0.481***	(0.09)
Observations	2,949		2,949		2,949	
Number of households	983		983		983	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5 (continued). The Pooled Regression Model Estimation results for household English proficiency

VARIABLES	(4)		(5)		(6)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.061***	(0.02)	0.039**	(0.02)	0.023	(0.02)
Monthly household income ($1,000)	0.011***	(0.00)	0.013***	(0.01)	0.013***	(0.01)
Long-term household income ($1,000)						
SNAP benefit ($1,000)	-0.084**	(0.04)	-0.061	(0.04)	-0.06	(0.04)
Paying rent	0.172***	(0.03)	0.139***	(0.03)	0.138***	(0.03)
Number of kids	0.041***	(0.01)	0.046***	(0.01)	0.047***	(0.01)
The youngest kid's age	-0.001	(0.00)	-0.004*	(0.00)	-0.004*	(0.00)
Household disability			0.120***	(0.02)	0.115***	(0.02)
Household elderly			0.041	(0.03)	0.037	(0.03)
Female household head			0.055	(0.04)	0.047	(0.04)
Married			-0.121***	(0.04)	-0.113***	(0.04)
Race						
Black only					0.034	(0.03)
Asian only					-0.005	(0.07)
Residual					0.006	(0.05)
Hispanic					-0.057*	(0.03)
Intercept	0.321***	(0.08)	0.397***	(0.08)	0.467***	(0.09)
Observations	2,949		2,949		2,949	
Number of households	983		983		983	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6. The Pooled Regression Model Estimation results for a language spoken at home

VARIABLES	(1)		(2)		(3)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.143***	(0.03)	0.080***	(0.03)	0.042	(0.04)
Monthly household income ($1,000)						
Long-term household income ($1,000)	0.006**	(0.00)	0.007**	(0.00)	0.007**	(0.00)
SNAP benefit ($1,000)	-0.113***	(0.04)	-0.098***	(0.04)	-0.098***	(0.04)
Paying rent	0.162***	(0.03)	0.136***	(0.03)	0.135***	(0.03)
Number of kids	0.047***	(0.01)	0.051***	(0.01)	0.051***	(0.01)
The youngest kid's age	-0.001	(0.00)	-0.004	(0.00)	-0.004	(0.00)
Household disability			0.116***	(0.02)	0.115***	(0.02)
Household elderly			0.052	(0.04)	0.045	(0.04)
Female household head			0.05	(0.04)	0.045	(0.04)
Married			-0.110***	(0.04)	-0.109***	(0.04)
Race						
Black only					0.035	(0.03)
Asian only					0.008	(0.08)
Residual					0.01	(0.05)
Hispanic					-0.044	(0.04)
Intercept	0.464***	(0.04)	0.500***	(0.05)	0.534***	(0.06)
Observations	2,949		2,949		2,949	
Number of households	983		983		983	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6 (continued). The Pooled Regression Model Estimation results for a language spoken at home

VARIABLES	(4)		(5)		(6)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.145***	(0.03)	0.079***	(0.03)	0.043	(0.03)
Monthly household income ($1,000)	0.011**	(0.00)	0.013***	(0.01)	0.013***	(0.01)
Long-term household income ($1,000)						
SNAP benefit ($1,000)	-0.076*	(0.04)	-0.058	(0.04)	-0.059	(0.04)
Paying rent	0.165***	(0.03)	0.137***	(0.03)	0.136***	(0.03)
Number of kids	0.043***	(0.01)	0.047***	(0.01)	0.047***	(0.01)
The youngest kid's age	-0.001	(0.00)	-0.003	(0.00)	-0.003	(0.00)
Household disability			0.116***	(0.02)	0.114***	(0.02)
Household elderly			0.046	(0.03)	0.039	(0.04)
Female household head			0.054	(0.04)	0.048	(0.04)
Married			-0.112***	(0.04)	-0.111***	(0.04)
Race						
Black only					0.034	(0.03)
Asian only					0.01	(0.08)
Residual					0.006	(0.05)
Hispanic					-0.043	(0.04)
Intercept	0.445***	(0.04)	0.483***	(0.05)	0.516***	(0.06)
Observations	2,949		2,949		2,949	
Number of households	983		983		983	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7. The Random Effects Model Estimation results for a language spoken at home

VARIABLES	(1)		(2)		(3)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.110***	(0.02)	0.047**	(0.02)	0.050*	(0.03)
Monthly household income ($1,000)						
Long-term household income ($1,000)	0.000	(0.00)	0.003	(0.00)	0.003	(0.00)
SNAP benefit ($1,000)	-0.228***	(0.03)	-0.203***	(0.03)	-0.200***	(0.03)
Paying rent	0.241***	(0.02)	0.194***	(0.02)	0.184***	(0.02)
Number of kids	0.048***	(0.01)	0.056***	(0.01)	0.054***	(0.01)
The youngest kid's age	-0.002	(0.00)	-0.005**	(0.00)	-0.005**	(0.00)
Household disability			0.147***	(0.02)	0.146***	(0.02)
Household elderly			0.115***	(0.03)	0.106***	(0.03)
Female household head			0.077**	(0.03)	0.060*	(0.03)
Married			-0.147***	(0.03)	-0.146***	(0.03)
Race						
Black only					0.099***	(0.03)
Asian only					0.006	(0.06)
Residual					0.082*	(0.04)
Hispanic					0.033	(0.03)
Intercept	0.348***	(0.04)	0.400***	(0.05)	0.378***	(0.05)
Observations	4,129		4,129		4,129	
Number of households	1808		1808		1808	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 (continued). The Random Effects Model Estimation results for a language spoken at home

VARIABLES	(4)		(5)		(6)	
	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)	Coefficient	(Std. Err.)
	Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise		Dependent variable: =1 if participates in SNAP; =0 otherwise	
Household English Proficiency	0.114***	(0.02)	0.049**	(0.02)	0.051*	(0.03)
Monthly household income ($1,000)	0.017***	(0.01)	0.019***	(0.01)	0.019***	(0.01)
Long-term household income ($1,000)						
SNAP benefit ($1,000)	-0.143***	(0.04)	-0.118***	(0.04)	-0.117***	(0.04)
Paying rent	0.250***	(0.02)	0.197***	(0.02)	0.187***	(0.02)
Number of kids	0.040***	(0.01)	0.048***	(0.01)	0.046***	(0.01)
The youngest kid's age	-0.002	(0.00)	-0.005**	(0.00)	-0.005**	(0.00)
Household disability			0.144***	(0.02)	0.144***	(0.02)
Household elderly			0.097***	(0.03)	0.089***	(0.03)
Female household head			0.085***	(0.03)	0.068**	(0.03)
Married			-0.152***	(0.03)	-0.151***	(0.03)
Race						
Black only					0.097***	(0.03)
Asian only					0.006	(0.06)
Residual					0.078*	(0.04)
Hispanic					0.031	(0.03)
Intercept	0.292***	(0.04)	0.355***	(0.05)	0.335***	(0.05)
Observations	4,129		4,129		4,129	
Number of households	1808		1808		1808	

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

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